

Institute of Paper Science and Technology
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**CONTINUOUS EVALUATION OF
CORRUGATING MEDIUM**
Project 1108-17
Progress Report 63
to
FOURDRINIER KRAFT BOARD INSTITUTE, INC.
April 1, 1960

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

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Progress Report 63

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THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

SUMMARY

The purpose of this study is to provide a continuous evaluation of the quality and runability of the corrugating mediums manufactured by members of the Fourdrinier Kraft Board Institute. Two rolls of corrugating medium are submitted on a weekly basis from the production of each machine. Each roll is evaluated for basis weight, caliper, Concora flat crush (conditioned after fluting), and runability, the latter being measured by corrugating each roll under standardized conditions into A-flute board at 600 feet per minute with minimum tension. If runability is unsatisfactory at this speed, the speed of the corrugator is reduced by increments of 25 f.p.m. until satisfactory runability is obtained as indicated by the absence of ruptured flutes. If the runability is satisfactory at 600 f.p.m. with minimum tension, the tension is increased by increments of 1/2 lb. per in. to determine the maximum tension at which satisfactory runability is obtained. The maximum tension used is 1-1/2 lb. per in. Flat crush tests are made on the single-faced board obtained at the maximum speed with minimum tension.

In addition to the evaluation carried out at the Institute as described above, each participant may, if he so desires, evaluate each roll of corrugating medium for Concora flat crush (conditioned after fluting) and submit the results to The Institute of Paper Chemistry, thus providing an opportunity to include a comparison of Institute and mill Concora flat crush results in the monthly progress reports.

The study, as described in the preceding paragraphs, provides several important benefits. For example, it enables each participant to evaluate his quality position in relation to the rest of the industry on a continuing basis. In addition, it provides a basis for comparing Concora flat crush results obtained at the Institute with those obtained at the mills on corresponding rolls of medium. This type of comparison is a helpful adjunct to conventional calibration procedures. Another benefit is provided by virtue of the fact that the study is accumulating an ever-growing reserve of background information essential for the judicious interpretation of any proposed specifications on corrugating medium whether on a company or industry basis.

During the month of March, 111 rolls of corrugating medium were submitted to The Institute of Paper Chemistry from the production of nineteen machines.

Shown below are the maximum and minimum current machine averages for each test (the current machine average is the average of the results obtained on all rolls submitted from a given machine during the current period); also given for each test is the current F.K.I. average which is determined by averaging the current machine averages for the previous twelve months (exclusive of the current period) and is indicative of the test level being maintained by the industry as a whole to the extent that the industry is represented by the participating machines:

	Maximum Current Machine Average	Minimum Current Machine Average	Current F.K.I. Average
Basis weight, lb.	29.0	25.4	27.4
Caliper, pt.	11.2	8.7	10.2
Concora flat crush, p.s.i. (Conditioned after fluting)	39.8	31.4	36.3
Single-face flat crush, p.s.i.	35.4	28.5	32.2

The runability data for the 111 rolls of medium evaluated during March are summarized as follows:

Runability	Number of Rolls	Percentage of Total Rolls
Less than 600 f.p.m. with minimum tension	None	0
600 f.p.m. with minimum tension	None	0
600 f.p.m. with tension of 1/2 lb. per in.	9	8.1
600 f.p.m. with tension of 1 lb. per in.	9	8.1
600 f.p.m. with tension of 1-1/2 lb. per in.	93	83.8

Concora flat crush results obtained on specimens conditioned after fluting were submitted for thirteen of the nineteen machines from which rolls were received during the current month. The comparisons of Concora flat crush test results based on the average result obtained at the Institute and at the mill for all rolls compared for each machine are summarized below. Shown in this summary is the number of machines (and the percentage of the total machines which they represent) whose Concora test averages fall within the indicated percentage ranges from the results obtained at the Institute on the same rolls.

Average Percentage Difference Between Institute and Mill Concora Flat Crush Test Results ^a	Number of Machines	Percentage of All Machines
<u>± 1.0</u>	2	15.4
<u>± 2.5</u>	5	38.5
<u>± 5.0</u>	9	69.2
<u>± 7.5</u>	10	76.9
<u>±10.0</u>	11	84.6
<u>±12.1</u>	12	92.3
<u>±17.2</u>	13	100.0

^a The average obtained at the Institute was used as the reference in the calculation of the percentage differences.

CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

PURPOSE OF THIS STUDY

The purpose of this study is to provide a continuous evaluation of the quality and runability of corrugating medium produced by members of the Fourdrinier Kraft Board Institute. The study, as it progresses, is accumulating a backlog of data and experience which provides several important benefits. For example, it enables each participant to evaluate his position in relation to the rest of the industry. In addition, it provides background information essential for the judicious interpretation of any proposed specifications on corrugating medium (on either a company or industry basis). The program also provides a basis for comparing Concora results obtained at the Institute with those obtained at the mills on corresponding rolls of medium. This comparison is a helpful adjunct to conventional calibration procedures.

PROCEDURE FOR PARTICIPATING

The procedure for participating in this study involves the submission of two rolls of corrugating medium per week from each machine to The Institute of Paper Chemistry. These rolls are taken from regular production runs on different days. Each roll is 10 to 12 inches wide and contains approximately 5,000 lineal feet of medium (approximately 30 inches in diameter). When received by the Institute, each roll is assigned a code letter and number. The rolls are numbered in the sequence in which they are received. Code letters are assigned on the basis of machines, and a given machine is assigned a

different code letter each month in order to mask the identity of the mills. For purposes of reference, an outline of this program which describes the necessary instructions for sampling was appended to Progress Report One in this series.

PRESENTATION AND DISCUSSION OF TEST RESULTS OBTAINED AT
THE INSTITUTE OF PAPER CHEMISTRY

During the month of March one hundred and eleven rolls of corrugating medium were selected from the production of nineteen machines and submitted to The Institute of Paper Chemistry for evaluation. A tabulation of the number of rolls submitted from each machine is given in Table I.

Each sample of corrugating medium was evaluated for basis weight, caliper, Concora flat crush (conditioned after fluting), H. and D. flat crush (single-faced board), and runability. (Concora flat crush results obtained on specimens tested immediately after fluting were included in Progress Reports 45 through 57.) Runability was measured by corrugating each roll under standardized conditions on the Institute's corrugator into A-flute board at 600 feet per minute with minimum tension. If unsatisfactory runability occurred at this speed, the corrugator was slowed down in increments of 25 f.p.m. until satisfactory runability was obtained (no ruptured flutes). If the medium fabricated satisfactorily at 600 f.p.m. with minimum tension, further runs were made at higher tensions to determine when cracking occurred. The higher tensions used were 0.5 lb. per inch, 1.0 lb. per inch, and 1.5 lb. per inch.

Flat crush was determined on the board obtained at a speed of 600 f.p.m. with minimum tension. In addition to information about quality, these

TABLE I

NUMBER OF ROLLS OF CORRUGATING MEDIUM SUBMITTED
FOR EVALUATION FROM EACH MACHINE

Machine Code	Number of Rolls
A	4
B	7
C	9
D	9
E	4
F	8
G	1
H	4
I	8
J	4
K	6
L	8
M	8
N	8
O	8
P	1
Q	8
R	4
S	<u>2</u>
Total	111

results will provide data which may be useful in studying the relationship between Concora flat crush and combined board flat crush for each participant's medium.

As requested by members of the F.K.B.I., the Concora medium test results are calculated on the basis of pounds of load per unit area rather than on the basis of the formula suggested by the Concora manufacturer and are reported as Concora flat crush test results. In Progress Reports One and Two, the Concora medium test results were reported on the basis of the formula suggested by the Concora manufacturer.

The average test results obtained on the rolls of corrugating medium submitted by each participant (current machine averages) are shown in Table II and graphically presented in Figures 1 to 4. In addition to a comparison of the test data obtained for the various machines, Table II also presents the current F.K.I. averages, cumulative F.K.I. averages, and the F.K.I. indexes. The current F.K.I. average is the average of test results for all machines participating in the study during the current month. The cumulative F.K.I. average is based on the results for the previous twelve-month period excluding the result for the current period. The F.K.I. index is obtained as follows:

$$\frac{\text{current F.K.I. average}}{\text{cumulative F.K.I. average}} \times 100 = \text{F.K.I. index (\%)}$$

The F.K.I. index provides a ready means of comparing the current quality with previous results. An index greater than 100% indicates that current quality is higher than the average result for the previous twelve periods; an index below 100% indicates that current quality is lower than the average result for the previous twelve periods.

TABLE II
SUMMARY OF CURRENT MACHINE AVERAGES
March, 1960

Code	Basis Weight, lb.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.
A	27.0	9.6	34.0	29.0
B	26.9	10.3	35.6	30.5
C	29.0	10.8	36.9	31.2
D	26.7	10.1	34.6	31.7
E	27.6	9.4	36.8	31.0
F	26.5	10.5	39.0	34.9
G	27.1	10.4	35.5	30.0
H	27.6	10.9	32.3	28.5
I	27.1	9.8	35.9	31.3
J	27.2	9.9	31.4	30.0
K	28.7	8.7	36.9	34.8
L	27.2	10.3	37.7	33.7
M	27.3	10.2	37.3	32.3
N	27.9	10.3	38.2	33.9
O	27.9	10.7	39.8	35.0
P	25.4	10.0	37.9	35.4
Q	28.9	10.0	35.2	32.0
R	27.9	11.2	37.9	31.8
S	27.5	10.9	36.0	34.9
Current F.K.I. Average	27.4	10.2	36.3	32.2
Cumulative F.K.I. Average	27.2	10.2	36.6	32.9
F.K.I. Index, %	100.8	100.0	99.1	97.8

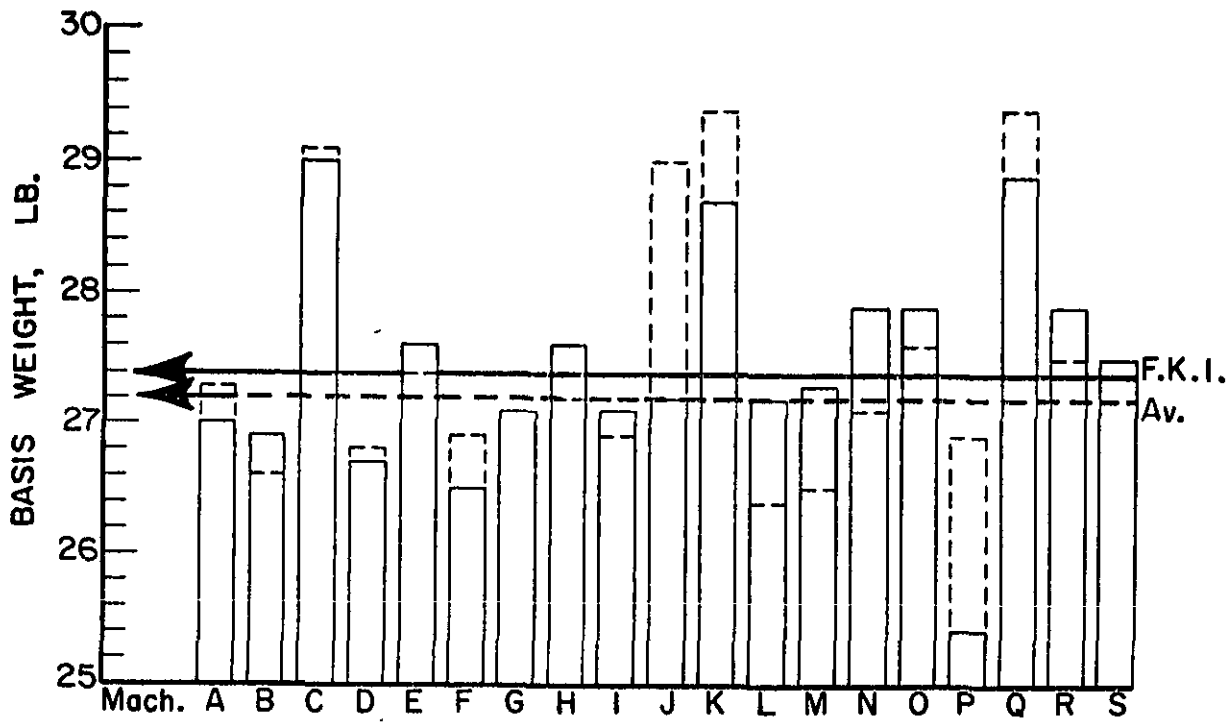


Figure 1

Comparison of Basis Weight Results for March, 1960

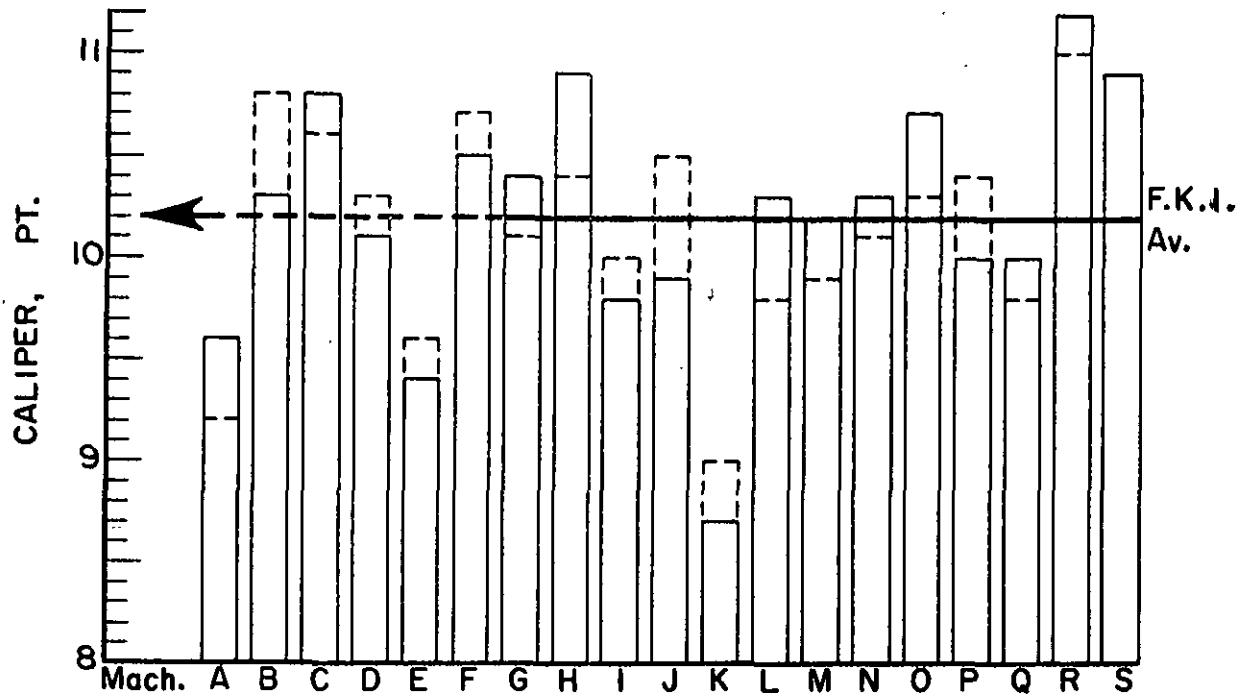


Figure 2

Comparison of Caliper Results for March, 1960

———— Current machine average
----- Cumulative machine average

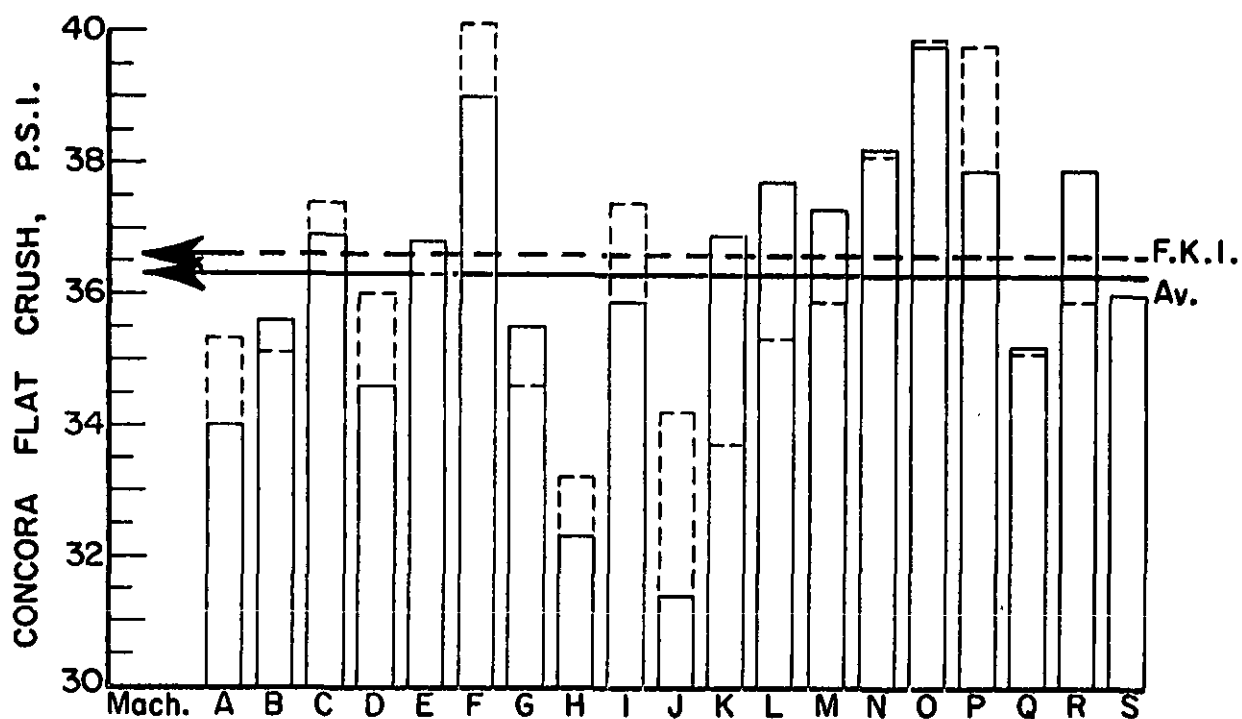


Figure 3
Comparison of Concora Flat Crush Results for March, 1960

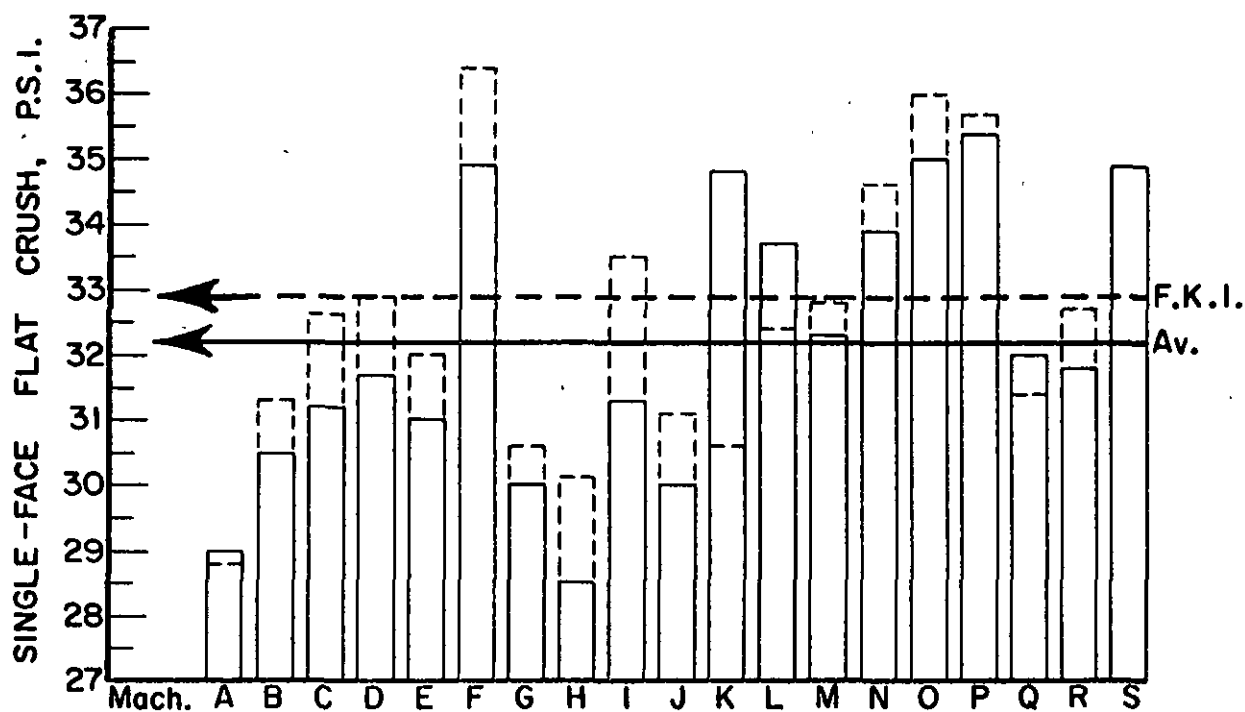


Figure 4
Comparison of Single-Face Flat Crush Results for March, 1960

———— Current machine average
----- Cumulative machine average

In Table II the current machine averages for the month of March are summarized. It may be noted in Table II and Figure 1 that basis weight varied from a low of 25.4 lb. for Machine P to a high of 29.0 lb. for Machine C. The current F.K.I. average for basis weight was 27.4 lb., which was higher than the cumulative F.K.I. average of 27.2 lb. Of the current machine averages shown in Table II, only the average for Mill P (which submitted only one roll for evaluation) was below the 26-lb. minimum requirement of Rule 41. On the basis of individual rolls, it may be noted that the tabulated data for each machine shown in Tables III through XXI included only one basis weight average which was below 26 lb.

With regard to the caliper results for the current period, it may be seen in Table II and also in Figure 2 that the lowest current machine average of 8.7 points was associated with Machine K and the highest average of 11.2 points was associated with Machine R. The current F.K.I. average of 10.2 points was the same as the cumulative F.K.I. average. The minimum caliper requirement of nine points specified in Rule 41 was met by all participants except Machine K on the basis of the current machine averages shown in Table II. On the basis of individual rolls, there were six caliper averages below 9 points.

The Concora flat crush averages are presented graphically in Figure 3 based on the data in Table II. An inspection of these results reveals that 39.8 p.s.i. was the highest average and 31.4 p.s.i. the lowest. Machine O had the highest average whereas Machine J had the lowest average. The current F.K.I. average of 36.3 p.s.i. was slightly lower than the cumulative F.K.I. average of 36.6 p.s.i.

The highest single-face flat crush average of 35.4 p.s.i. was obtained on the medium from Machine P and the lowest of 28.5 p.s.i. on the medium from Machine H. These data are shown in Table II and are presented graphically in Figure 4. The current F.K.I. average was 32.2 p.s.i., whereas the cumulative F.K.I. average was 32.9 p.s.i.

The runability data for the 111 rolls of medium evaluated during March are summarized as follows:

Runability	Number of Rolls	Percentage of Total Rolls
Less than 600 f.p.m. with minimum tension	None	0
600 f.p.m. with minimum tension	None	0
600 f.p.m. with tension of 1/2 lb. per in.	9	8.1
600 f.p.m. with tension of 1 lb. per in.	9	8.1
600 f.p.m. with tension of 1-1/2 lb. per in.	93	83.8

For the current period, the current F.K.I. average for basis weight was higher than the respective cumulative F.K.I. average, the current F.K.I. average for caliper was the same as the cumulative F.K.I. average, and the current F.K.I. averages for Concora flat crush and single-face flat crush were lower than their respective cumulative F.K.I. averages. For each test, the difference between the current and cumulative F.K.I. averages did not appear to be significantly large.

The test results obtained on the sample lots submitted from the production of each of the machines are shown in Tables III through XXI for Machines A through S, respectively. The maximum, minimum, and average test

results obtained on each sample lot are shown for all tests except basis weight for which only the average is shown; in addition, the over-all average result for all sample lots submitted from a given machine is shown for each test. The latter over-all averages are reported as "current machine averages." A cumulative machine average is also shown and is calculated by averaging the current machine averages for the previous twelve periods (excluding the current period). Also shown for each machine in Tables III to XXI are the machine factor and machine index which are defined as follows:

$$\frac{\text{current machine average}}{\text{cumulative machine average}} \times 100 = \text{machine factor (\%)}$$

$$\frac{\text{current machine average}}{\text{cumulative F.K.I. average}} \times 100 = \text{machine index (\%)}$$

The machine factor and machine index provide a means for comparing the current machine average with either the previous results for that particular machine or with the cumulative results for all machines--i.e., the cumulative F.K.I. average.

TABLE III
SUMMARY OF TEST RESULTS FOR MACHINE A
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, P.s.i.	Single-Face Flat Crush, P.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
A-1	2-10-60	2-26-60	5	27.2	10.0 9.2	37.8 33.6 36.5	31.4 29.8 30.5	1/2
A-2	2-10-60	2-26-60	6	27.1	10.1 9.2	38.4 36.0 37.4	31.6 30.4 31.1	1/2
A-3	2-29-60	3-17-60	7	26.3	10.0 9.0	33.6 29.4 31.4	28.6 26.8 27.9	1-1/2
A-4	2-29-60	3-17-60	8	27.0	9.9 9.0	33.6 27.6 30.6	27.6 25.4 26.4	1-1/2
Current Machine Average				27.0	9.6	34.0	29.0	
Cumulative Machine Average				27.3	9.2	35.3	28.8	
Machine Factor, %				98.9	104.3	96.2	100.7	
Machine Index, %				99.3	94.4	92.9	83.0	

TABLE IV
SUMMARY OF TEST RESULTS FOR MACHINE B
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, P.s.i.	Single-Face Flat Crush, P.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
B-1	2-9-60	2-26-60	31	27.4	11.1 10.3	40.8 35.4 38.6	35.4 31.8 33.2	1-1/2
B-2	2-14-60	2-26-60	32	27.7	11.3 10.2	37.2 34.8 36.4	32.8 31.0 32.0	1
B-3	2-17-60	2-26-60	33	26.8	10.0 9.0	33.6 31.2 32.4	29.2 27.2 28.2	1-1/2
B-4	2-23-60	3-1-60	34	26.1	10.3 9.7	37.2 34.2 35.9	30.6 27.6 29.2	1
B-5	3-3-60	3-21-60	35	26.2	10.7 9.7	36.0 30.0 33.0	31.4 27.6 30.0	1-1/2
B-6	3-11-60	3-23-60	36	27.1	11.1 10.2	38.4 31.8 35.2	29.8 27.6 28.7	1-1/2
B-7	3-17-60	3-23-60	37	27.1	10.5 9.9	39.6 36.0 37.4	32.4 31.6 32.1	1-1/2
Current Machine Average				26.9	10.3	35.6	30.5	
Cumulative Machine Average				26.6	10.8	35.1	31.3	
Machine Factor, %				101.0	95.1	101.3	97.5	
Machine Index, %				98.8	101.3	97.2	92.5	

TABLE V
SUMMARY OF TEST RESULTS FOR MACHINE C
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
C-1	2-17-60	2-26-60	309	28.7	11.8 11.0 11.3	35.4 33.0 34.1	30.2 27.6 28.3	1-1/2
C-2	2-19-60	2-26-60	310	29.2	11.8 10.9 11.3	41.4 36.0 38.8	33.2 30.2 31.8	1-1/2
C-3	2-22-60	2-26-60	311	28.5	11.2 10.4 10.8	37.8 34.8 36.4	31.6 29.8 30.8	1-1/2
C-4	2-24-60	3-11-60	312	28.7	11.2 10.2 10.9	37.8 34.8 36.4	32.2 28.6 30.4	1-1/2
C-5	3-2-60	3-11-60	313	29.7	10.9 10.4 10.8	39.6 34.2 37.4	32.6 30.6 31.8	1-1/2
C-6	3-4-60	3-11-60	314	29.8	11.1 10.7 10.9	40.2 34.8 37.1	34.2 30.0 31.7	1-1/2
C-7	3-9-60	3-17-60	315	28.5	10.7 10.0 10.4	40.8 34.2 37.8	33.4 31.6 32.2	1-1/2
C-8	3-11-60	3-17-60	316	29.8	11.1 10.5 10.9	39.0 36.6 37.9	34.2 31.0 32.4	1-1/2
C-9	3-13-60	3-17-60	317	28.3	10.0 9.8 10.0	37.2 35.4 36.2	33.4 30.0 31.4	1-1/2
Current Machine Average				29.0	10.8	36.9	31.2	
Cumulative Machine Average				29.1	10.6	37.4	32.6	
Machine Factor, %				99.8	101.8	98.7	95.8	
Machine Index, %				106.6	106.2	100.8	94.8	

TABLE VI
SUMMARY OF TEST RESULTS FOR MACHINE D
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Max.	Min.	Max.	Min.	
D-1	2-9-60	2-29-60	242	27.1	10.6	10.0	39.0	33.0	33.4	30.6	1/2
D-2	2-11-60	3-7-60	243	26.2	10.1	9.8	36.0	32.4	32.8	30.6	1-1/2
D-3	2-15-60	3-7-60	244	26.5	10.7	10.0	35.4	31.8	32.2	30.8	1-1/2
D-4	2-19-60	2-29-60	245	26.5	10.3	10.0	37.8	34.8	34.6	30.8	1
D-5	2-22-60	2-29-60	246	26.9	10.9	10.3	36.0	31.2	31.6	29.6	1/2
D-6	2-26-60	3-7-60	247	26.4	10.2	10.0	36.0	30.0	33.2	30.8	1-1/2
D-7	2-29-60	3-21-60	248	26.9	10.3	9.9	36.0	31.8	33.8	30.2	1-1/2
D-8	3-3-60	3-21-60	249	26.3	10.2	9.7	35.4	33.0	31.2	29.6	1-1/2
D-9	3-5-60	3-21-60	250	27.7	10.2	9.2	36.0	33.0	34.4	29.6	1-1/2
Current Machine Average											
				26.7	10.1		34.6		31.7		
Cumulative Machine Average				26.8	10.3		36.0		32.9		
Machine Factor, %				99.8	98.9		96.1		96.2		
Machine Index, %				98.2	99.7		94.6		96.2		

TABLE VII
SUMMARY OF TEST RESULTS FOR MACHINE E
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.			
E-1	2-19-60	2-29-60	261	27.9	10.1	9.6	40.2	35.4	30.8
E-2	2-19-60	2-29-60	262	26.3	9.7	8.9	34.8	32.6	29.8
E-3	3-9-60	3-14-60	269	28.1	10.0	8.8	39.6	36.0	28.0
E-4	3-9-60	3-15-60	270	28.2	9.7	8.1	40.2	36.0	32.4
Current Machine Average				27.6	9.4		36.8		35.0
Cumulative Machine Average				27.4	9.6		36.3		33.0
Machine Factor, %				100.6	98.5		101.3		31.2
Machine Index, %				101.4	92.7		100.5		34.1

TABLE VIII

SUMMARY OF TEST RESULTS FOR MACHINE F
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
F-1	2-22-60	2-29-60	545	26.1	10.7 9.3	42.6 37.8	35.4 32.8	34.2 1-1/2
F-2	2-25-60	3- 3-60	546	27.4	11.0 10.7	44.4 40.2	40.4 37.6	39.5 1-1/2
F-3	3- 1-60	3- 7-60	547	26.4	11.0 10.0	43.2 33.6	37.2 34.2	35.3 1-1/2
F-4	3- 4-60	3- 8-60	548	26.0	10.7 9.3	42.0 34.3	36.0 34.0	34.8 1-1/2
F-5	3- 8-60	3-14-60	549	26.3	11.7 10.7	42.0 33.0	36.2 34.0	35.0 1-1/2
F-6	3-11-60	3-15-60	550	26.5	10.8 10.0	39.5 34.8	35.2 32.4	34.0 1-1/2
F-7	3-17-60	3-22-60	551	27.4	10.7 9.7	39.6 34.3	33.0 31.6	32.6 1-1/2
F-3	3-22-60	3-25-60	552	26.3	11.3 10.3	41.4 36.0	35.0 32.2	33.5 1-1/2
Current Machine Average				26.5				
Cumulative Machine Average				26.9				
Machine Factor, %				98.7				
Machine Index, %				97.5				

TABLE IX

SUMMARY OF TEST RESULTS FOR MACHINE G
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
G-1	2- 6-60	2-29-60	4	27.1	10.8 10.2	37.2 34.2	31.0 28.6	30.0 1-1/2
Current Machine Average				27.1				
Cumulative Machine Average				27.1				
Machine Factor, %				100.0				
Machine Index, %				99.4				

TABLE X

SUMMARY OF TEST RESULTS FOR MACHINE H
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 500 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
H-1	2-24-60	3-2-60	265	27.5	10.9 10.3	35.4 29.4	29.0 26.4	1-1/2
H-2	2-24-60	3-2-60	266	27.7	10.3 10.3	34.2 30.0	31.6 30.0	1-1/2
H-3	3-3-60	3-25-60	273	27.7	11.5 10.8	34.3 31.2	27.6 27.0	1-1/2
H-4	3-8-60	3-25-60	274	27.3	11.5 10.3	34.2 30.0	25.4 27.4	1-1/2
Current Machine Average								
					10.9	32.3	28.5	
Cumulative Machine Average					10.4	33.2	30.1	
Machine Factor, %					104.2	97.2	94.6	
Machine Index, %					106.6	98.2	96.6	

TABLE XI

SUMMARY OF TEST RESULTS FOR MACHINE I
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 500 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
I-1	2-20-60	3-2-60	348	27.0	10.0 9.3	39.0 34.3	34.0 30.0	1-1/2
I-2	2-22-60	3-2-60	349	27.6	10.1 9.4	36.6 33.0	31.6 31.2	1-1/2
I-3	2-26-60	3-7-60	350	27.1	10.1 9.7	38.4 34.2	33.2 30.3	1-1/2
I-4	3-2-60	3-7-60	351	26.5	10.0 9.2	34.2 30.6	31.6 29.6	1-1/2
I-5	3-4-60	3-21-60	352	27.6	10.8 10.0	33.4 33.6	31.6 29.6	1-1/2
I-6	3-13-60	3-21-60	353	27.1	9.9 9.3	38.4 34.2	31.0 29.6	1
I-7	3-14-60	3-21-60	354	26.0	9.4 9.0	36.0 34.8	31.2 26.6	1/2
I-8	3-17-60	3-25-60	355	27.6	10.0 9.8	39.0 36.6	35.2 32.0	1-1/2
Current Machine Average								
					9.8	35.9	31.3	
Cumulative Machine Average					10.0	37.4	33.5	
Machine Factor, %					98.2	95.9	93.2	
Machine Index, %					96.6	93.0	95.0	

TABLE XII
SUMMARY OF TEST RESULTS FOR MACHINE J
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
J-1	2-24-60	3-2-60	9	26.3	10.1 8.3	32.4 23.2 29.9	30.4 26.8 28.8	1-1/2
J-2	2-25-60	3-2-60	10	26.9	9.9 8.9	34.2 27.0 30.1	31.8 29.0 30.1	1-1/2
J-3	3-3-60	3-14-60	11	27.5	10.8 10.0	33.6 30.0 32.4	30.3 27.8 29.4	1-1/2
J-4	3-4-60	3-11-60	12	27.6	10.8 10.0	34.2 31.8 33.2	33.6 30.6 31.5	1-1/2
Current Machine Average								
				27.2	9.9	31.4	30.0	
Cumulative Machine Average				29.0	10.5	34.2	31.1	
Machine Factor, %				93.7	94.4	91.8	96.4	
Machine Index, %				100.0	97.2	85.8	90.9	

TABLE XIII
SUMMARY OF TEST RESULTS FOR MACHINE K
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
K-1	2-19-60	3-2-60	7	28.4	9.2 3.5	35.4 32.4 34.2	35.2 33.0 33.8	1-1/2
K-2	2-19-60	3-2-60	8	28.3	8.6 7.6	39.0 32.4 35.6	33.8 31.0 32.6	1-1/2
K-3	2-21-60	3-2-60	9	27.9	9.1 8.1	39.6 36.0 37.4	36.6 34.4 35.2	1-1/2
K-4	2-25-60	3-2-60	10	23.7	9.2 8.1	43.2 39.6 41.2	39.0 35.6 37.2	1-1/2
K-5	3-3-60	3-14-60	11	29.7	9.2 8.4	39.6 36.6 37.9	36.4 34.0 35.1	1-1/2
K-6	3-9-60	3-14-60	12	28.6	9.1 8.3	38.4 33.0 35.2	36.2 34.0 34.8	1-1/2
Current Machine Average								
				28.7	8.7	36.9	34.8	
Cumulative Machine Average				29.4	9.0	33.7	30.6	
Machine Factor, %				97.5	96.6	109.6	113.8	
Machine Index, %				105.3	85.3	100.9	105.6	

TABLE XIV

SUMMARY OF TEST RESULTS FOR MACHINE L
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concra Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
				Max.	Min.	Max.	Min.	Av.
L-1	2-22-60	3-2-60	--	22.0	10.7	10.2	10.3	35.4
L-2	2-26-60	3-2-60	--	27.6	11.6	10.1	10.5	35.4
L-3	2-29-60	3-9-60	--	27.2	10.2	10.0	10.0	33.9
L-4	3-5-60	3-9-60	--	26.3	10.2	9.9	10.1	34.2
L-5	3-7-60	3-15-60	--	27.7	10.7	10.2	10.4	32.0
L-6	3-10-60	3-15-60	--	27.1	10.8	10.0	10.3	33.5
L-7	3-14-60	3-23-60	--	27.4	10.7	10.0	10.3	32.5
L-8	3-17-60	3-23-60	--	26.8	10.6	10.0	10.2	34.6
Current Machine Average				27.2	10.3			33.3
Cumulative Machine Average				26.4	9.8			33.7
Machine Factor, %				103.4	104.4			32.4
Machine Index, %				100.1	100.8			103.9

TABLE XV

SUMMARY OF TEST RESULTS FOR MACHINE M
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concra Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
				Max.	Min.	Max.	Min.	Av.
M-1	2-23-60	3-2-60	--	26.8	10.7	9.9	10.1	32.2
M-2	2-26-60	3-2-60	--	26.9	10.2	9.9	10.0	32.2
M-3	3-2-60	3-9-60	--	28.3	10.9	10.5	10.7	33.6
M-4	3-4-60	3-9-60	--	27.1	10.8	10.1	10.4	30.8
M-5	3-8-60	3-15-60	--	27.4	10.9	10.0	10.5	33.3
M-6	3-11-60	3-15-60	--	27.7	10.5	10.0	10.2	29.5
M-7	3-15-60	3-23-60	--	26.7	10.1	9.7	9.9	32.0
M-8	3-19-60	3-23-60	--	27.4	10.5	9.9	10.2	31.6
Current Machine Average				27.3	10.2			31.0
Cumulative Machine Average				26.5	9.9			32.3
Machine Factor, %				102.9	103.2			32.8
Machine Index, %				100.2	100.7			98.3

TABLE XVI
SUMMARY OF TEST RESULTS FOR MACHINE N
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points		Concora Flat Crush, p.s.i.		Single-Face Flat Crush, p.s.i.		Runability, Maximum Tension at 600 f.p.m., lb./in.			
					Max.	Min.	Max.	Min.	Max.	Min.				
N-1	2-24-60	3-2-60	--	27.6	10.5	10.0	10.2	42.6	38.4	39.8	36.6	32.4	34.2	1-1/2
N-2	2-27-60	3-2-60	--	28.1	10.8	10.2	10.5	39.0	34.8	37.2	35.2	32.8	33.7	1-1/2
N-3	3-3-60	3-9-60	--	28.4	10.5	10.2	10.3	40.8	36.0	38.2	39.2	35.6	36.9	1/2
N-4	3-5-60	3-9-60	--	28.1	11.0	10.4	10.7	39.6	35.4	37.7	39.0	34.6	35.8	1-1/2
N-5	3-9-60	3-15-60	--	27.4	10.2	10.0	10.1	38.4	35.0	37.1	33.4	30.6	31.7	1
N-6	3-12-60	3-15-60	--	27.8	10.2	9.9	10.0	40.2	36.0	38.0	34.6	32.8	33.8	1-1/2
N-7	3-16-60	3-23-60	--	27.6	10.7	10.0	10.3	39.6	36.0	37.9	32.6	31.0	31.9	1-1/2
N-8	3-19-60	3-23-60	--	27.9	10.3	10.2	10.5	42.6	37.8	39.7	35.6	31.6	33.4	1-1/2
Current Machine Average				27.9			10.3			38.2			33.9	
Cumulative Machine Average				27.1			10.1			38.1			34.6	
Machine Factor, %				103.0			102.2			100.2			98.1	
Machine Index, %				102.3			101.5			104.4			103.0	

TABLE XVII
SUMMARY OF TEST RESULTS FOR MACHINE O
March, 1960

O-1	2-17-60	3-7-60	383	27.6	10.2	10.0	10.1	42.0	38.4	39.8	34.8	34.0	34.3	1-1/2
O-2	2-23-60	3-3-60	384	28.0	11.4	10.6	11.0	40.2	38.4	39.1	36.0	32.6	33.8	1
O-3	2-26-60	3-11-60	385	28.4	10.9	10.3	10.6	46.2	40.8	43.0	39.2	37.8	38.4	1
O-4	3-1-60	3-11-60	386	28.1	11.0	10.5	10.8	43.2	36.0	39.6	34.4	33.0	33.7	1-1/2
O-5	3-3-60	3-15-60	387	27.6	11.0	10.0	10.7	45.6	36.6	39.6	35.2	32.4	33.6	1-1/2
O-6	3-8-60	3-25-60	388	27.4	11.0	10.5	10.7	40.2	36.6	38.9	38.6	35.4	36.7	1-1/2
O-7	3-12-60	3-25-60	389	27.6	10.9	10.3	10.7	42.0	34.8	38.2	36.8	32.0	33.8	1-1/2
O-8	3-15-60	3-25-60	390	28.7	11.3	10.6	11.0	42.6	39.0	40.3	37.6	33.4	35.8	1-1/2
Current Machine Average				27.9			10.7			39.8			35.0	
Cumulative Machine Average				27.6			10.3			39.9			36.0	
Machine Factor, %				101.3			103.5			99.8			97.3	
Machine Index, %				102.6			105.1			108.8			106.3	

TABLE XX
SUMMARY OF TEST RESULTS FOR MACHINE R
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
R-1	3-3-60	3-7-60	269	28.2	11.2 10.8	33.4 36.6	31.8 31.2	1-1/2
R-2	3-3-60	3-7-60	270	28.4	11.7 11.0	32.4 35.4	32.6 29.2	1-1/2
R-3	3-17-60	3-21-60	277	27.6	11.5 10.9	43.2 35.4	34.2 31.0	1-1/2
R-4	3-17-60	3-21-60	273	27.5	11.7 10.9	42.6 37.2	34.0 31.6	1-1/2
Current Machine Average				27.9	11.2			
Cumulative Machine Average				27.5	11.0			
Machine Factor, %				101.6	101.3			
Machine Index, %				102.6	109.8			

TABLE XXI

SUMMARY OF TEST RESULTS FOR MACHINE S
March, 1960

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.	Runability, Maximum Tension at 600 f.p.m., lb./in.
					Max. Min. Av.	Max. Min. Av.	Max. Min. Av.	
S-1	2-18-60	3-14-60	2236	26.5	10.9 10.2	37.2 31.2	34.0 32.8	1
S-2	2-22-60	3-14-60	3135	28.4	11.7 10.8	39.0 36.6	33.4 36.0	1/2
Current Machine Average				27.5	10.9			
Cumulative Machine Average				--	--			
Machine Factor, %				--	--			
Machine Index, %				100.9	107.0			

DISCUSSION OF CONCORA FLAT CRUSH TEST RESULTS OBTAINED AT THE
INSTITUTE OF PAPER CHEMISTRY AND THOSE OBTAINED AT THE MILLS

In Table XXII a comparison of Institute and mill Concora flat crush test results obtained on conditioned specimens is given for the month of March. These comparisons were initiated in Progress Report 30 and permit interested participants to submit their Concora flat crush test results to The Institute of Paper Chemistry so that comparative results may be included in the monthly reports. Data sheets for supplying this information may be obtained from the Institute. Comparisons of this kind are a helpful adjunct to other calibration procedures. It may be noted in Table XXII that thirteen of the nineteen participating machines are included in this comparison of Concora flat crush data. Shown in Table XXII are the Institute and mill Concora averages for each roll included in this comparison, the difference between the roll average based on Institute data and that based on mill data, the Institute and mill averages based on all rolls included in the comparison, and the difference between these over-all averages.

The Concora flat crush data shown in Table XXII are summarized in Part I of Table XXIII where for each machine the following information is given: (1) Current machine average based on Institute data, (2) current machine average based on mill data, (3) the average difference--that is, the difference between the current machine average based on Institute data and that based on mill data and (4) the maximum difference encountered in comparing Institute and Mill test averages for individual rolls. In Part II of Table XXIII the average difference of Part I has been converted to per cent by dividing it by the Institute average and multiplying the result by 100. The average differences in per cent

TABLE XXII
INSTITUTE AND MILL CONCORDA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR MARCH, 1960

Machine A										Machine E									
Concorda Flat Crush, P.S.I.					Machine D					Concorda Flat Crush, P.S.I.					Machine I				
Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill
A-1	5	2-10-60	36.5	34.1	-2.4	D-1	242	2-9-60	36.1	34.1	-2.0	E-1	261	2-19-60	37.8	37.4	-0.4		
A-2	6	2-10-60	37.4	35.2	-2.2	D-2	243	2-11-60	34.8	37.9	+3.1	E-2	262	2-19-60	32.6	34.3	+1.7		
A-3	7	2-29-60	31.4	32.8	+1.4	D-3	244	2-15-60	34.1	37.3	+3.2	E-3	269	3-9-60	38.0	42.7	+4.7		
A-4	8	2-29-60	30.6	32.9	+2.3	D-4	245	2-19-60	36.0	34.3	-1.2	E-4	270	3-9-60	38.6	40.0	+1.4		
					D-5	246	2-22-60	34.0	33.4	+4.4									
					D-6	247	2-26-60	33.4	34.9	+1.5									
					D-7	248	2-29-60	34.4	36.3	+2.4									
					D-8	249	3-3-60	34.1	37.2	+3.1									
					D-9	250	3-5-60	34.8	35.4	+0.6									
Current Machine Av.		34.0		33.8	-0.2	Current Machine Av.		34.6	36.3	+1.7	Current Machine Av.		36.8	38.6	+1.8				
Machine F										Machine H									
Concorda Flat Crush, P.S.I.					Machine G					Concorda Flat Crush, P.S.I.					Machine J				
Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill
F-1	545	2-22-60	39.7	38.9	-0.8	H-1	265	2-24-60	31.6	35.2	+3.6	I-1	348	2-20-60	36.6	39.0	+2.4		
F-2	546	2-25-60	42.4	44.6	+2.2	H-2	266	2-24-60	32.0	35.2	+3.2	I-2	349	2-22-60	35.0	39.1	+4.1		
F-3	547	3-1-60	40.1	40.7	+0.6	H-3	273	3-8-60	33.5	37.2	+3.7	I-3	350	2-26-60	36.5	38.1	+1.6		
F-4	548	3-4-60	39.4	40.0	+0.6	H-4	274	3-8-60	32.0	37.2	+5.2	I-4	351	3-2-60	32.6	40.2	+7.6		
F-5	549	3-8-60	37.2	43.8	+6.6							I-5	352	3-4-60	36.2	40.1	+3.9		
F-6	550	3-11-60	36.7	40.1	+3.4							I-6	353	2-13-60	36.5	38.2	+1.7		
F-7	551	3-17-60	37.3	41.3	+4.0							I-7	354	3-14-60	35.5	39.2	+3.7		
F-8	552	3-22-60	38.9	37.8	-1.1							I-8	355	3-17-60	37.9	40.2	+2.3		
Current Machine Av.		39.0		40.9	+1.9	Current Machine Av.		32.3	36.2	+3.9	Current Machine Av.		35.9	39.3	+3.4				
Machine L										Machine M									
Concorda Flat Crush, P.S.I.					Machine N					Concorda Flat Crush, P.S.I.					Machine O				
Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill	Roll No.	Date Made	Insti- tute	Diff- erence ^a	Mill
L-1	--	2-22-60	38.5	36.0	-2.5	M-1	--	2-23-60	35.4	36.5	+1.1	N-1	--	2-24-60	39.8	37.3	-2.5		
L-2	--	2-26-60	39.4	35.8	-3.6	M-2	--	2-26-60	37.6	38.2	+0.6	N-2	--	2-27-60	37.2	39.5	+2.3		
L-3	--	2-29-60	37.8	37.8	0.0	M-3	--	3-2-60	41.0	40.1	-0.9	N-3	--	3-3-60	38.2	40.1	+1.9		
L-4	--	3-5-60	36.0	37.1	+1.1	M-4	--	3-4-60	36.6	35.6	-1.0	N-4	--	3-5-60	37.7	36.1	-1.6		
L-5	--	3-7-60	38.8	38.9	+0.1	M-5	--	3-8-60	36.6	36.7	+0.1	N-5	--	3-9-60	37.1	35.4	-1.7		
L-6	--	3-10-60	35.3	37.0	+1.7	M-6	--	3-11-60	35.2	35.3	+0.1	N-6	--	3-12-60	38.0	38.6	+0.6		
L-7	--	3-14-60	38.4	42.5	+4.1	M-7	--	3-15-60	38.9	35.9	-3.0	N-7	--	3-16-60	37.9	36.4	-1.5		
L-8	--	3-17-60	37.7	37.3	-0.4	M-8	--	3-19-60	37.0	35.9	-1.1	N-8	--	3-19-60	39.7	38.5	-1.2		
Current Machine Av.		37.7		37.8	+0.1	Current Machine Av.		37.3	36.3	-0.5	Current Machine Av.		38.2	37.7	-0.5				

^a This difference is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

TABLE XXII--CONTINUED
INSTITUTE AND MILL CONCORDIA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR MARCH, 1960

Machine O					Machine P					Machine R				
Code	Roll No.	Date Made	Concordia Flat Crush, P.S.I. Insti-tute	Difference a	Code	Roll No.	Date Made	Concordia Flat Crush, P.S.I. Insti-tute	Difference a	Code	Roll No.	Date Made	Concordia Flat Crush, P.S.I. Insti-tute	Difference a
0-1	383	2-17-60	39.8	-1.8	P-1	192	2-7-60	37.9	-1.9	R-1	259	3-3-60	37.6	+3.5
0-2	384	2-23-60	39.1	-1.1						P-2	270	3-3-60	37.0	+6.4
0-3	385	2-28-60	43.0	-1.4						R-3	277	3-17-60	38.0	+10.8
0-4	386	3-1-60	39.6	-0.5						R-4	278	3-17-60	39.0	+5.5
0-5	387	3-3-60	39.6	-0.5										
0-6	377	3-8-60	38.9	+0.9										
0-7	389	3-12-60	38.2	+0.9										
0-8	390	3-15-60	40.3	-2.4										
Current Machine Av.			39.8	-0.7	Current Machine Av.			37.9	-1.9	Current Machine Av.			37.9	+6.5

Machine S				
S-1	2286	2-18-60	34.4	+2.8
S-2	3135	2-22-60	37.6	+2.1
Current Machine Av.			36.0	+2.4

^a This difference is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

for the current report and the two preceding reports are shown. It may be seen that, for the current period, the highest average difference of 17.2% was associated with Machine R and the lowest of 0.3% with Machine L. Differences greater than five per cent were noted for Machines H, I, R, and S. Differences greater than ten per cent were noted for Machines H and R. In the majority of comparisons, agreement between Institute and mill data was good, as evidenced by the following comparison of Institute and mill Concora flat crush results which shows the number of machines (and the cumulative percentage of all machines which this number represents) whose average Concora flat crush test results for the month of March fall within designated percentage ranges from the corresponding data obtained at the Institute:

Average Percentage Difference Between
Institute and Mill Concora Flat
Crush Test Results ^a

	Number of Machines	Percentage of All Machines
± 1.0	2	15.4
± 2.5	5	38.5
± 5.0	9	69.2
± 7.5	10	76.9
± 10.0	11	84.6
± 12.1	12	92.3
± 17.2	13	100.0

^a The average obtained at the Institute was used as the reference in the calculation of the percentage differences.

TABLE XXIII

PART I: A COMPARATIVE SUMMARY FOR EACH MACHINE OF THE CONCORRA FLAT CRUSH AVERAGES BASED ON INSTITUTE DATA

AND THOSE BASED ON MILL DATA

Machine Code	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Number of Rolls Compared	4	0	0	9	4	8	0	4	8	0	0	8	8	8	8	1	0	4	2
Concorra Flat Crush, p.s.i.																			
Current Machine Av. (Institute) ^a	34.0	--	--	34.6	36.8	39.0	--	32.3	35.9	--	--	37.7	37.3	38.2	39.8	37.9	--	37.9	36.0
Current Machine Av. (Mill) ^a	33.8	--	--	36.3	38.6	40.9	--	36.2	39.3	--	--	37.8	36.8	37.7	39.1	36.0	--	44.4	38.4
Average Difference ^b	-0.2	--	--	+1.7	+1.8	+1.9	--	+3.9	+3.4	--	--	+0.1	-0.5	-0.5	-0.7	-1.9	--	+6.5	+2.4
Maximum Difference ^c	-2.4	--	--	+4.4	+4.7	+6.6	--	+5.2	+7.6	--	--	+4.1	-3.0	-2.5	-2.4	-1.9	--	-10.8	+2.8

PART II: A TABULATION FOR EACH MACHINE OF THE AVERAGE DIFFERENCE (PER CENT) BETWEEN THE CONCORRA FLAT CRUSH AVERAGE

BASED ON INSTITUTE DATA AND THAT BASED ON MILL DATA

Average Difference, % ^d																			
Current Report (March)	-0.6	--	--	+4.9	+4.9	+4.9	--	+12.1	+9.5	--	--	+0.3	-1.3	-1.3	-1.8	-5.0	--	+17.2	+6.7
51st Report (February)	0.0	--	--	-2.0	+4.0	+7.6	--	+10.5	+3.6	--	--	-0.6	+0.3	-0.8	+1.3	-8.6	--	+1.9	--
59th Report (January)	+6.0	--	--	+2.6	+7.6	+6.0	--	+3.3	+4.3	--	--	+6.1	-1.1	+2.5	-1.1	-5.9	--	+12.3	--

^a Comparisons based on current machine average include only those rolls for which mill data were submitted.

^b Average difference is the difference between the current machine average based on Institute test results and that based on mill test results with the Institute test results used as the reference. See Table XXII.

^c Maximum difference is the greatest difference encountered in comparing Institute and mill test averages for individual rolls. See Table XXII.

^d Average difference (per cent) is computed by dividing the average difference in p.s.i. (shown above in Part I of this table) by the Institute current machine average and multiplying the result by 100.

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